

**Odessa National Medical University**  
**Faculty \_\_ Pharmaceutical \_\_\_\_\_**  
**Department \_\_ Clinical Chemistry and Laboratory Diagnostics\_**

Syllabus course  
**"PHYSICAL AND COLLOID CHEMISTRY"**

Scope	120 hours /4,0 ECTS
Semester, year of study	2 year of study, 4th semester.
Days, time, place	Place of classes: Odessa, Olgievskaya street, 4a (The main building of ONMedU), department of clinical chemistry and laboratory diagnostics. Days and times of classes: According to the schedule of the educational department
Teacher(s)	1. Menchuk Kateryna, Associate 2. Shyrykalova Anzhela, Associate Professor 3. Professor Sidelnykova Tetiana, Associate Professor 4. Burdina Ianina, Associate Professor
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Workplace	Odessa, st. Olgiivska, 4a (Main building of ONMedU), Department of Clinical Chemistry and Laboratory Diagnostics.
Consultations	According to the schedule posted on the information stand of the department

### COMMUNICATION

Communication with students will be carried out in the classroom.  
During distance learning, communication is carried out through the Microsoft Teams platform, as well as through e-mail correspondence, via Viber, Telegram, WhatsApp messengers.

### COURSE ANNOTATION

The subject of the discipline is the physical phenomena that accompany physico-chemical and colloid-chemical processes in the environment and living organisms.

Prerequisites and postrequisites of the course physical and colloid chemistry - one of the fundamental disciplines in the system of higher pharmaceutical education, which is based on general, inorganic, analytical chemistry, as well as the basics of mathematics and physics. Knowledge of the theoretical foundations of physical and colloid

chemistry is necessary for in-depth study of biological, pharmaceutical and toxicological chemistry, pharmacognosy and drug technology.

The purpose of the course. To provide a clear idea of the theoretical foundations, current state and practical application of the general laws of physical and colloid chemistry, to formulate skills and abilities to apply the acquired knowledge in future practice and the competent use of chemicals and materials in the pharmaceutical industry.

The task of the discipline: to form a theoretical worldview of future professionals on the manufacture, quality control and storage of drugs, as well as their biotransformation in the human body in terms of the basic principles of physical and colloid chemistry.

**Expected results:**

1. Ability to show knowledge in practical situations;
2. Ability to use knowledge and understanding of the subject area and understanding of the profession;
3. Understanding of self-regulation and leading a healthy lifestyle, the ability to adapt and act in a new situation;
4. Ability to be aware of the choice of communication strategy; ability to work in a team; interpersonal skills;
5. Ability to communicate, formulate and solve problems effectively in the native language, both orally and in writing;
6. Ability to use some information and communication technologies;
7. Understanding of applied techniques and methods of design and research analysis and their limitations in accordance with specialization;
8. Ability to analyze and evaluate chemical processes, select and apply suitable standard analytical, calculation and experimental methods, interpret research results;
9. Practical skills for solving complex problems of chemical and biological projects and research in accordance with specialization;
10. Ability to collect, interpret relevant data and analyze complexities within a specialization to make judgments that highlight social and ethical issues;
11. Understanding the desire to preserve the environment;
12. Ability to demonstrate the current level of knowledge of relevant issues in physical colloid chemistry in relation to solving problems of medicine and pharmacy;
13. Ability to organize, provide and analyze drugs;
14. Ability to develop methods for quality control of medicines, pharmaceutical substances, medicinal plant raw materials and excipients using physical, physico-chemical and chemical methods of control;

**COURSE DESCRIPTION**

Forms and methods of teaching

The course will be presented in the form of lectures (30 hours), seminars (20 hours), practical (40 hours), organization of independent work of students (30 hours).

In accordance with the provisions of higher education, curricula, the standard of the university for quality management of training, the main forms of teaching the discipline are: lectures, practical classes, laboratory work, independent work of students.

When studying the discipline "Physical and Colloid Chemistry" lectures are held with the use of multimedia materials.

Practical classes are held in classrooms and include explanations, conversations, surveys on the topic of the lesson, as well as laboratory work.

Students' independent work is to study the material of lectures, as well as to prepare for and defend practical work, prepare for current and final control, perform training tests, search for information from literature and the Internet and conduct elements of scientific work.

Students' scientific work is carried out in the work of circles, preparation and speeches at scientific student conferences, writing articles.

### The content of the discipline

Topic 1. Introductory lesson Subject and tasks of physical colloid chemistry Basic concepts of thermodynamics.

Topic 2. The first law of thermodynamics. Thermochemistry. Hess's law.

Topic 3. The second law of thermodynamics. Thermodynamic potentials and criteria for assessing the direction of processes

Topic 4. Solutions. Colligative properties of solutions

Topic 5. Thermodynamics of electrolyte solutions.

Topic 6. Buffer solutions. Mechanism of action.

Topic 7. Buffer capacity.

Topic 8. Electrical conductivity of electrolyte solutions. Electrode potentials

Topic 9. Classification of galvanic cells. EMF of galvanic cells. Potentiometry. Potentiometric titration

Topic 10. Chemical kinetics and classification of reactions by kinetic feature

Topic 11. Influence of factors on the speed of chemical processes. Speed constant

Topic 12. Catalysis, theories of catalysis. Study of H<sub>2</sub>O<sub>2</sub> decomposition rate

Fundamentals of enzymatic catalysis. Use of catalysts

Topic 13. Thermodynamics of chemical equilibrium. Chemical equilibrium constant.

Topic 14. Colloidal chemistry. General characteristics. Basic concepts and definitions. Disperse systems. Their classification.

Topic 15. Methods of obtaining dispersed systems.

Topic 16. Methods of dispersed system purification.

Topic 17. Surface phenomena and their practical significance. Surface activity.

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Topic 18. Sorption processes and their theoretical justification.  
Topic 19 Adsorption at the interface of different phases.  
Topic 20. Adsorption of electrolytes, ion exchange adsorption  
Topic 21. Molecular kinetic properties of colloidal systems. Sedimentation.  
Topic 22. Optical properties of colloidal systems. Nephelometry  
Topic 23. Electrical properties of lyozoles. Micelle structure and DEL.  
Topic 24. Stability and coagulation  
Topic 25. Basic concepts of HMC. Formation of HMC solutions. Properties of gels

Test control in physical colloid chemistry

List of recommended reading

Basic:

1. Фізична і колоїдна хімія/ За ред. В.І.Кабачного, - Харків: Прапор, 1999. - 368с.
2. Біофізична та колоїдна хімія/ А.С.Мороз, Л.Г.Яворська. Д.Д.Луцевич та ін - Вінниця: НОВА КНИГА, 2007.-600 с.
3. Евстратова К.И., Купина Н.А., Малахова Е.Е. Физическая и коллоидная химия. - М.: Высшая школа, 1990 - 487 с.
4. Красовский И.В.. Вайль Е.И., Безуглый В.Д. Физическая и коллоидная химия. - Киев: Вища школа, 1983. - 345 с.
5. Фізична та колоїдна хімія: базовий підручник для студентів вищих фармацевтичних навчальних закладів (фармацевтичних факультетів) IV рівня акредитації / В.І.Кабачний, Л.Д.Грицан, Т.О.Томаровская та ін.; за ред. В.І.Кабачного: - 2-ге вид., перераб. Та доп. - Харків: Нфай: Золоті сторінки, 2015. - 432 с. - (Національний підручник).
6. Medical chemistry/ V.O.Kalibabchuk, V.I.Halynska, L.I.Hrysbchenko and other; edited by V.O.Kalibabchuk: Second ed.-Kyiv:AUS Medicine Publishing, 2012.-223p.

Auxiliary:

6. Фізична та колоїдна хімія. Лабораторний практикум: Навч. посіб. для студ. вищ. фармац. навч. закладів / В.І.Кабачний, В.П.Колєснік. Л.Д.Грицаи та ін.; За ред. В.І.Кабачного.- Х.: Вид-во НФАУ: Золоті сторінки, 2004,- 200с.
7. Практикум по физической и коллоидной химии/ Под ред. К.И. Евстратовой. - М.: Высшая школа, 1990. - 255 с.
8. Фізична та колоїдна хімія. Збірник задач: Навч. посібник для студ. вищ. фармац. закладів освіти / В.І.Кабачний, Л.К.Осіпенко. Л.Д.Грицан та ін.; За ред. В.І.Кабачного,- Вид-во НФАУ: Золоті сторінки. 2001.- 208с.
9. Сборник тестовых заданий по физической и коллоидной химии. Учеб. пособие для студ. высш. фармац. учеб. заведений / В.И.Кабачный, Л.Д.Грицан.

- Л.К.Осипенко, 'Г.А.Томаровская, Я.А.Лабузова. В.П.Колесник. Гюд ред. проф. В. И. Кабачного. - Х.: Изд-во НФаУ, 2007. - 224 с.
10. Захарченко В.11 Коллоидная химия - М.: Высшая школа. 1989. - 238с.
11. Фролов Ю.Г. Курс коллоидной химии.- М.: Химия. 1988.- 464с.

## EVALUATION

The assessment of the discipline consists of two components:

- 50% - current performance (arithmetic mean of all student grades);
- 50% grade on the exam.

The current educational activity of the student is evaluated in practical and seminar classes on a 4-point (traditional) scale.

Criteria for assessing students' knowledge for current educational activities:

- "excellent" (5) points are awarded to a student who is fluent in the material of the ticket program, supports the discussion on the issues set out in the ticket, is able to write basic kinetic equations, structure of colloidal particles, thermochemical equations, mechanism of action and pH values for buffer solutions, describe electrode processes and potentials in biosystems .

good "(4) points are awarded to a student who is fluent in the material of the ticket program, is able to write the basic equations, but admits some insignificant errors (inaccuracies) in answering the questions.

-- "satisfactory" (3) points are awarded to a student who is proficient in all questions of the ticket program and has mastered the question of the minimum qualification..

- "unsatisfactory" - (2) points are obtained by a student who has significant gaps in knowledge of the program material, makes fundamental errors in explaining the laws of physical and colloid chemistry, does not have the necessary practical skills. Grades "unsatisfactory" are given to students who are not suitable to continue their studies at a medical university and perform their professional duties without additional mastering of Physical and Colloid chemistry.

Thus, the department puts two assessments in the statement:

1) the arithmetic mean of all current estimates (calculated as a number rounded to 2 (two) decimal places);

2) traditional grade for the exam.

The average score for the discipline (traditional grade) is calculated as the arithmetic mean of current performance and examination grade.

The received grade for the discipline is considered as a percentage of mastering the required amount of knowledge in this subject.

GPA for the discipline	The ratio received by the student average score for the discipline to the	Score from discipline on a 4-
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	maximum possible value this indicator	point scale (traditional assessment)
4,5 – 5,0	90-100%	5
4,0 – 4,45	80-89%	4
3,75 – 3,95	75-79%	4
3,25 – 3,7	65-74%	3
3,0 – 3,2	60-64%	3

Individual calculation of the percentage of mastering the discipline is carried out using the proportion.

The obtained percentage of knowledge acquisition in this discipline allows to convert to a score on a 100-point scale.

Further calculations are made by the information and computer center of the university.

According to the scores obtained on a 100-point scale, students are evaluated on the ECTS rating scale. Students enrolled in one course (one specialty) on the basis of the number of points scored in the discipline are ranked on the ECTS scale as follows:

ECTS score	Statistical indicator
«A»	The best 10 % of students

«B»	The next 25 % of students
«C»	The next 30 % of students
«D»	The next 25 % of students
«E»	The last 10 % of students

Methods of current control include assessment of current learning activities (current control) - is based on daily control of theoretical knowledge, practical skills in accordance with specific objectives for each topic and control of practical skills - are carried out after each section based on control of theoretical knowledge, practical skills and skills.

Ongoing control is carried out by oral questioning or conversation or test control or written control.

The final control (exam in the discipline "Physical and Colloid Chemistry") is conducted in the form of an oral questioning of 4 questions in the ticket. The student is given up to 30 minutes to prepare for the oral answer.

Additional (bonus) points a student can receive for individual tasks:

- participation and report in the student scientific conference;
- participation in the Olympiad with a report on the student scientific circle;
- preparation of multimedia slides and tests;
- translations of scientific articles from foreign languages;
- abstract work on a particular topic.

The number of points accrued for different types of individual tasks depends on their scope and significance, are determined by the standard and working programs of the discipline and are added to the sum of points earned by students for current academic activities for a particular section. Grades for individual tasks are charged to the student only if they are successfully completed and defended. The grade is added to the current performance.

**Independent work of students.**

Tasks for independent work are the general obligatory tasks allocated in workbooks which the student should prepare for each employment; keeping notes, filling out a workbook, learning vocabulary, studying subtopics that do not require explanation.

Students' independent work, which is provided by the topic of the lesson along with the classroom work, is assessed during the current control of the topic in the relevant lesson. Assimilation of topics that are submitted only for independent work is checked during the exam.

## **COURSE POLICY**

**Deadline and recompilation policy:**

It is expected that students will attend all lectures and practical classes. If they missed classes, it is necessary to work it out (according to the schedule posted on the information stand of the department and according to the permission of the dean's office, if necessary).

Reassignment of control of mastering of practical skills is carried out during a semester individually with the decision of time of carrying out working off.

Reassignment of unsatisfactory grades is carried out in the last month of study of the discipline under the conditions that the average score for the current educational activity is less than 3.00 (conducted according to the schedule posted on the information stand of the department).

The exam in the discipline is carried out according to the schedule of the educational process. The student is admitted to the exam if he / she attends all classes, receives a positive grade on the tests of practical skills and tests of Step I in physical and

colloid chemistry (moodle, Teams) and has an average score for current learning activities of at least 3.00

**Academic Integrity Policy:**

Observance of academic integrity by students of education provides:

- independent performance of educational tasks, tasks of current control and examination (for persons with special educational needs this requirement is applied taking into account their individual needs and possibilities);
- links to sources of information in the case of the use of ideas, developments, statements, information;
- compliance with the legislation on copyright and related rights;
- providing reliable information about the results of their own (scientific, creative) activities, used research methods and sources of information.

Unacceptable in educational activities for participants in the educational process are:

- use of family or business ties to obtain a positive or higher assessment in the implementation of any form of control over learning outcomes or advantages in scientific work;
- use of prohibited auxiliary materials or technical means (cheat sheets, abstracts, headphones, telephones, smartphones, tablets, etc.) during control measures;
- passing the procedures of control of learning outcomes by fictitious persons.

For violation of academic integrity, students may be held subject to the following academic liability:

- reduction of results of assessment of control work, examination, credit, etc .;
- re-passing the assessment (test, exam, test, etc.);
- appointment of additional control measures (additional individual tasks, tests, tests, etc.);
- re-passing the relevant educational component of the educational program;
- conducting additional verification of other works by the infringer.

**Attendance and lateness policy:**

Attendance at lectures and practical classes is mandatory. If you are more than 15 minutes late, the lesson is considered missed and needs to be practiced.

**Mobile devices:**

During practical classes, the use of a smartphone, tablet or other device for storing and processing information is allowed only with the permission of the teacher.

The use of mobile devices and their accessories is strictly prohibited during any control.

**Audience behavior:**

During classes it is allowed: to leave the audience for a short time if necessary and with the permission of the teacher; take photos of presentation slides; take an active part in the class.

During classes it is forbidden: to eat (except for persons whose special medical condition requires another - in this case, medical confirmation is required); smoking, drinking alcohol and even low-alcohol beverages or drugs; to use obscene language or use words that offend the honor and dignity of colleagues and faculty; gaff; to damage the material and technical base of the university (damage inventory, equipment; furniture, walls, floors, litter the premises and territories); shouting, shouting or listening to loud music in classrooms and even in corridors during classes.